PATTERN AND PERSISTENCE IN THE BURROWS OF TWO SPECIES OF THE FRESHWATER CRAYFISH, *PARASTACOIDES* (DECAPODA: PARASTACIDAE), IN SOUTHWEST TASMANIA

Parastacoides spp. burrow extensively in the acid, peaty soil of western Tasmania and two or more species can commonly be found in close sympatry. The habitat is often partitioned zonally on the basis of soil conditions, especially drainage, on slopes (Richardson and Swain, 1980). This paper describes a mosaic of habitat partition between two undescribed species.

Methods

The field site, in southwest Tasmania, consists of an area of gently-sloping heathland (annual rainfall *c.* 2000 mm; mean maximum daily temperatures: 22.8°C; Watson, 1978). On a grid of 108 contiguous 4m^2 quadrats, the positions of all burrow entrances of each species were recorded four times from 1980 to 1990. *Parastacoides* sp.1 constructs burrows with several entrances grouped in and around a water-filled depression, while *P.* sp.2 burrows have only one or two entrances which are often roofed over with excavated soil.

Seven environmental parameters were measured in each quadrat: buttongrass area, soil depth, soil compressibility, water content, root depth (proportion of the soil profile occupied by roots; this horizon was clearly demarcated from inorganic soil below), mean water table depth, and water table variability.

Results and Discussion

About 160 *P.* sp.1 and 150 *P.* sp.2 entrances were present, the species sometimes within 2m of each other. The general pattern of burrow distribution varied very little over 10 years with no major burrow systems (these mostly belong to *P.* sp.1) appearing or disappearing. There has been some turnover in the overall number of entrances in both species, highest in *P.* sp.2, and an overall decline in the number of *P.* sp.2 entrances.

In these peaty, sedgeland habitats at least, *Parastacoides* burrows persist much longer than their inhabitants because the soils are very coherent and because the occupants do not have to burrow extensively to obtain food (Growns and Richardson, 1988).

Since the burrow systems are occupied by only a single adult, and burrow occupancy is greater than 90%, the stability of the burrows over the 10 year period argues that the crayfish populations are stable, or in the case of *P.* sp.2, declining. Since uncolonised habitat appears to be available to both species, what factors control population numbers?

Dry conditions in southern Tasmania over the last 10 years may be responsible for the decline in *P.* sp.2. This species occupies a drier part of the habitat and, although it can tolerate a few weeks without free water in its burrow (Fradd, 1979), it is probably more vulnerable to drought than *P.* sp.1.

For *P.* sp.1, food seems unlikely to be limiting (Growns and Richardson, 1988), physical space is available and predation of adults by birds and marsupials only occurs rarely. But there is heavy juvenile mortality during the year, or more, which they spend in the parental burrow, and there must also be heavy mortality when the sub-adults establish new burrows. Only one new system was observed in the course of this study, so sub-adults apparently take over vacant burrows.

The quadrats were ordinated on the basis of the 7 environmental variables, appropriately transformed, using principal components analysis. The first two axes accounted for 77.5% of the overall variation. The quadrats grouped on the basis of the identity of burrows which were within 0.5 m of the centre of the quadrat (where the environmental variables were measured): the groups were clearly separated. *P.* sp.1 burrows were associated with deeper, wetter, spongier soils. Unburrowed quadrats were not separated from burrowed ones, suggesting that the habitat is not saturated.

Other *Parastacoides* spp. (Richardson and Swain, 1980; Richardson and Horwitz, 1988) occur parapatrically where better drained soils on slopes rise out of deeper muck peats on valley floors; this pattern has been observed between the two species studied here at a neighbouring site. But where slopes are shallow, the change in soils is indistinct and the resulting mosaic of conditions allows fine scale coexistence as described here.

Acknowledgements

Thanks to those who helped in the field, Stephanie Kalish for laboratory assistance and the Tasmanian Department of Parks Wildlife and Heritage for permission to work in the Southwest National Park.

Literature Cited

Fradd, F.J. 1979. 'Aspects of the ecophysiology of the freshwater crayfish *Parastacoides tasmanicus* (Clark 1936)'. Unpublished Ph.D. thesis, Department of Zoology, University of Tasmania.

Growns, I.O. and Richardson, A.M.M. 1988. The diet and burrowing habits of the freshwater crayfish *Parastacoides tasmanicus tasmanicus* Clark (Decapoda: Parastacidae). Australian Journal of Marine and Freshwater Research 39: 525–534.

Richardson, A.M.M. and Horwitz, P.H.J. 1988. Habitat partitioning in parastacid crayfish. Freshwater Crayfish 7: 91–97.

Richardson, A.M.M. and Swain, R. 1980. Habitat requirements and geographical distribution of three subspecies of *Parastacoides tasmanicus* and *Engaeus cisternarius* (Crustacea; Decapoda: Parastacidae), burrowing crayfish from south west Tasmania. Australian Journal of Marine and Freshwater Research 31: 475–484.

Watson, B. 1978. 'Climate, Lower Gordon River Scientific Survey'. (Hydro-Electric Commission: Hobart). 51p.

Alastair M.M. Richardson and Roy Swain, Department of Zoology, University of Tasmania, Box 252c, GPO Hobart, Tasmania 7001, Australia.